Examiner's Copy

AN 122:319508 HCA
TI **Steel** sheets for deep-drawn **cans** and their manufacture
IN Sato, Daizo; Shimizu, Keiichi; Nishama, Shigeyoshi; Fukuyama, Satoshi
PA Toyo Kohan Co Ltd, Japan
SO Jpn. Kokai Tokkyo Koho, 7 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 07034192	A2	19950203	JP 1993-197825	19930714
	JP 10030152	A2	19980203	JP 1997-100770	19930714
PRAI	JP 1993-197825		19930714		

AB The title sheets are made of **steel** contg. **C** 0.01-0.15, Si .ltoreq.0.05, **Mn** .ltoreq.0.9, P .ltoreq.0.04, S .ltoreq.0.04, Al 0.015-0.10, and **N** 0.002-0.015%. The **steel** is hot rolled, cold rolled, continuously annealed with heat cycle including overaging, and temper rolled at **elongation** ratio 0.5-2.0%. In the **steel**, the av. crystal **grain** size is .ltoreq.6.0 .mu.m.

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-034192

(43)Date of publication of application : 03.02.1995

---

(51)Int.Cl. C22C 38/00
C21D 9/52
C22C 38/06

---

(21)Application number : 05-197825

(22)Date of filing : 14.07.1993

(71)Applicant : TOYO KOHAN CO LTD

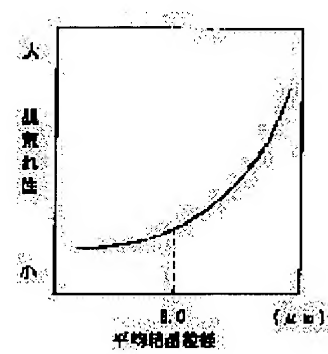
(72)Inventor : SATO DAIZO
SHIMIZU KEIICHI
NISHIYAMA SHIGEYOSHI
FUKUYAMA SATOSHI

---

(54) STEEL SHEET SUITABLE FOR APPLICATION TO THINNED DEEP-DRAWN CAN AND ITS PRODUCTION

(57)Abstract:

PURPOSE: To obtain a steel sheet for a thinned deep-drawn can excellent in workability, surface roughening properties and corrosion resistance by subjecting a steel sheet having a specified compsn. constituted of C, Si, Mn, P, S, Al, N and Fe to specified skinpass rolling and forming specified crystalline grains.



CONSTITUTION: A steel slab contg. 0.01 td 0.15% C, ≤0.05% Si, ≤ 0.9% Mn, ≤0.04% P, ≤0.04% S, 0.015 to 0.10% Al and 0.0020 to 0.015% N and furthermore contg., at need, 0.001 to 0.020% Nb, and the balance Fe with inevitable impurities is subjected to hot rolling at about the Ar3 point or above. This hot rolled steel sheet is subjected to to cold rolling at about ≥75% draft. This cold rolled steel sheet is annealed by a heat cycle including averaging treatment. After that, the steel sheet is subjected to skinpass rolling at 0.5 to 2.0% elongation percentage or DR rolling at 20 to 50% draft. Thus, the average grain size is regulated to ≤6.0μm. In this way, the steel sheet free from the generation of the breakage of the barrel at the time of continuous high speed can producing, furthermore excellent in workability and suitab for the application to a thinned deep-drawn can be obtd.

LEGAL STATUS

[Date of request for examination]	17.02.1995
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	2676581
[Date of registration]	25.07.1997
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The steel plate which performed annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and temper rolling with a pace of expansion of 0.5 - 2.0% one by one C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%, and fitted the thinning deep-drawing can use whose diameter of average crystal grain of the steel plate after temper rolling is 6.0
[Claim 2] C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, The steel plate which performed annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and DR rolling at 20 - 50% of rolling reductions one by one, and fitted the thinning deep-drawing can use whose diameter of average crystal grain of the steel plate after DR rolling is 6.0 micrometers or less.
[Claim 3] C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, The hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity Nb:0.001-0.020% The steel plate which performed annealing by the thermo cycle including cold rolling and overaging processing, and temper rolling with a pace of expansion of 0.5 - 2.0% one by one, and fitted the thinning deep-drawing can use whos diameter of average crystal grain of the steel plate after temper rolling is 6.0 micrometers or less.
[Claim 4] C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, The hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity Nb:0.001-0.020% The steel plate which performed annealing by the thermo cycle including cold rolling and overaging processing, and DR rolling at 20 - 50% of rolling reductions one by one, and fitted the thinning deep-drawing can use whose diamete of average crystal grain of the steel plate after DR rolling is 6.0 micrometers or less.
[Claim 5] Continuous annealing in the thermo cycle which includes cold rolling and overaging processing for the ho rolled sheet steel which consists of the remainder Fe and an unescapable impurity C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%, the manufacturing method of the steel plate suitable for the thinning deep-drawing can use which performs temper rolling with a pace of expansio of 0.5 - 2.0% one by one.
[Claim 6] Annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled she steel which consists of the remainder Fe and an unescapable impurity C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%, the manufacturing method of the steel pla suitable for the thinning deep-drawing can use which performs DR rolling at 20 - 50% of rolling reductions one by o

[Claim 7] Annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled she steel which consists of the remainder Fe and an unescapable impurity C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, and Nb:0.001-0.020%, the manufacturing meth of the steel plate suitable for the thinning deep-drawing can use which performs temper rolling with a pace of expansion of 0.5 - 2.0% one by one.
[Claim 8] Annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled she steel which consists of the remainder Fe and an unescapable impurity C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, and Nb:0.001-0.020%, the manufacturing meth of the steel plate suitable for the thinning deep-drawing can use which performs DR rolling of 20 - 50% of rolling reductions one by one.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] About container material, such as a food can and a drink can, especially this invention is excellent in deep-drawing processability, and its surface deterioration nature is good and it relates to the steel plate suitable for the corrosion resistance outstanding thinning deep-drawing can use, and its manufacturing method.
[0002]
[Description of the Prior Art] conventionally, as a method of fabricating a side non-joint (side -- seamless) can, a res film is beforehand covered to the method of giving an organic paint within and without the can after fabricating a surface treated steel sheet, and the metal plate before fabrication, a resin film is used as a kind of forming lubricant, a there is the so-called thinning drawing can fabricating method which carries out the thinning of the metal plate of the portion used as a can side attachment wall As a latter example, this invention persons proposed the metal plate excellent in the surface deterioration-proof nature after canning, and corrosion resistance for thinning drawing cans previously by specifying the diameter of average crystal grain and average surface roughness of a metal plate (refer t JP,4-314535,A).
[0003]
[Problem(s) to be Solved by the Invention] However, when a thinning drawing can is fabricated using the convention metal plate which covered the resin film beforehand, there is a problem of a surface deterioration plain-gauze cone in the can side attachment wall after completion extremely. That is, the path clearance of a dice and punch is larger than the thickness of a can side attachment wall, and since a can side attachment wall is not restrained by punch and the d but serves as the so-called free surface at the time of processing, compared with the DI (Draw and Ironing) fabricatin method, there is a problem of a surface deterioration plain-gauze cone in a can side attachment wall. If this surface deterioration state arises, the adhesion force of a negative and a film will decrease and it will also become the cause o film ablation. Moreover, the shock from the outside, such as contact of the cans under transportation, becomes a trigger, and surface deterioration makes a film plane produce a detailed crack, as a result also has the problem of causing corrosion resistance degradation. Usually, a thinning deep-drawing can pierces cladding to disc-like, and two steps of spinning fabricates this. The thickness of a can side attachment wall is decreased by applying the high blank holder force to a flange at the time of the second step of this spinning (redrawing processing), and performing drawin buckling-of-track processing of a can side attachment wall. In the above-mentioned processing method, since redrawing processing was the very severe fabricating method, there was a problem that body breaking tends to happe at the time of continuous molding. If such body breaking happens, in order to spoil the productivity of high-speed canning processing, it was pressing need to develop the steel plate suitable for the thinning deep-drawing can use wh body breaking could not happen easily and was moreover excellent in processability. Surface deterioration nature an corrosion resistance are excellent for the purpose of solving the above-mentioned trouble, and body breaking does no occur at the time of continuation high-speed canning processing, but this invention aims at offering the steel plate suitable for the thinning deep-drawing can use which was moreover excellent in processability, and its manufacturin method.
[0004]
[Means for Solving the Problem] The steel plate suitable for the thinning deep-drawing can use of this invention C:0 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, Annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists o the remainder Fe and an unescapable impurity, and temper rolling with a pace of expansion of 0.5 - 2.0% are perform

one by one, and it is desirable for the diameter of average crystal grain of the steel plate after temper rolling to be 6.0 micrometers or less. Moreover, C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%, annealing by the thermo cycle which includes cold rolling and overaging processin for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and DR rolling at 20 - 50% of rolling reductions are performed one by one, and that whose diameter of average crystal grain of the steel pla after DR rolling is 6.0 micrometers or less is Furthermore, C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, Nb:0.001-0.020%, Annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and a unescapable impurity, and temper rolling with a pace of expansion of 0.5 - 2.0% may be performed one by one, and diameter of average crystal grain of the steel plate after temper rolling may be 6.0 micrometers or less. Moreover, C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, Nb:0.001-0.020%, Annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and DR rolling at 20 - 50% of rolling reductions are performed one by one, and it is desirable for the diameter of average crystal grain of the steel plate after DR rolling to be also 6.0 micrometers or less. Next, as for the manufacturing method of the steel plate suitable for the thinning deep-drawing can use of this invention, it is desirable to perform annealing by the thermo cy which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder F and an unescapable impurity, and temper rolling with a pace of expansion of 0.5 - 2.0% one by one C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 to 0.015% Moreover, it is also desirable to perform annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and DR rolling at 20 - 50% of rolling reductions one by one C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%. Furthermore, you may perform annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and temper rolling with a pace of expansion of 0.5 - 2.0% one by one C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, and Nb:0.001-0.020%. Moreover, is also desirable to perform annealing by the thermo cycle which includes cold rolling and overaging processing for t hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and DR rolling of 20 - 50% of rolling reductions one by one C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, and Nb:0.001-0.020%.

[0005]

[Function] Resin films, such as polyester, are covered to the steel plate of this invention, it pierces to disc-like, and th thinning deep-drawing can which body breaking did not occur but was moreover excellent in processability in this ev if it performed continuation high-speed canning processing of 2 stage drawing can be fabricated.

[0006]

[Example]

The component steel component of a hot rolled sheet steel consists of Remainder Fe and an unescapable impurity C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S= 0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%. Moreover, what added Nb to the above-mentioned component 0.001 to 0.02% is used suitably. The reason for regulation of a steel component is explained below. When C became less than 0.01%, it caused big and rough-ization crystal grain, and it made the minimum 0.01%. On the other hand, since spinning nature deteriorated exceeding 0.15 the range was made into 0.08 - 0.15%. Although Si was an element detrimental to corrosion resistance as a charge of can material, it is an element contained unescapable as aluminum killed steel, and made the upper limit 0.05%. Although Mn was a component required in order to prevent the red shortness under hot-rolling by S which is an impurity, since it deteriorated spinning nature as on the other hand exceeding 0.9%, it made the upper limit 0.9%. Although P is a component effective in grain refining and it is added at a fixed rate from raising the intensity of a negative, corrosion resistance is ****(ed) by one side. When P exceeded 0.04% as a steel-for-can board of this invention use, corrosion resistance and since especially ******-proof fell remarkably, the upper limit was made into 0.04%. S was an impurity component which produces the red shortness under hot-rolling, as much as possible, although the few thing was desirable, is an element contained unescapable and made the upper limit 0.04%. Althoug is added in a steel bath as a deoxidizer and aluminum is removed as a slag on the occasion of steel manufacture, sinc the deoxidation effect stabilized when there were few additions is not acquired, it needs 0.015% or more. Moreover,

aluminum reacts with **** N, deposits as AlN, and contributes to grain refining of crystal grain. On the other hand, since there were few technical effects and they were not desirable on economy, the addition exceeding 0.10% made t upper limit 0.10%. since it will be easy to produce a crack on a slab front face and will become a structure defect, if there are few deposits with a nitride when fewer than 0.002%, the effect of grain refining is lost and 0.015% is exceeded on the other hand, although N forms aluminum and Nb, and a nitride and it is a component effective in gra refining of a fine-grain grain -- the range -- 0.002 - 0.015% -- the bottom Nb has an effect in grain refining of crystal grain, and contributes to reduction of Dissolution C and N. when fewer than 0.001%, there was no effect of grain refining, and the upper limit was made into 0.020%, in order for the amount of dissolution Nb(s) to increase and to cause degradation of spinning nature conversely on the other hand, if 0.020% is exceeded

[0007] Although slab heating temperature and hot rolling conditions are not specified by this invention, as for slab heating temperature, it is desirable to consider as 1100 degrees C or more from the standpoint of positive decomposition dissolution of N and stable reservation of hot rolling temperature. It is hot rolling finishing temperatu Ar3 Since it will be made big and rough while the crystalline structure of a hot-rolling board mixed-grain-size-izes if carries out to below a point, hot rolling finishing temperature is Ar3. It carried out to beyond the point. Moreover, sin crystal grain will turn big and rough and surface deterioration will produce winding temperature if it makes a minimu 450 degrees C in consideration of the quality stability of the coil cross direction at the time of hot-rolling, and a longitudinal direction and 650 degrees C is exceeded, winding temperature has the desirable range of 450-650 degre C.

[0008] Since a cold rolling process rolling reduction cannot bring about coarsening of a steel plate, or mixed-grain-si ization at an annealing process and cannot carry out grain refining of the crystal grain enough at less than 75%, as fo the rolling reduction of cold rolling, it is desirable to make 75% into a minimum.

[0009] In the annealing process this invention, it became clear by adopting annealing by the thermo cycle including overaging processing that an effect is in body breaking. This is considered to be based on what Dissolution C and N reduced. Which art in the case where overaging processing is performed by continuous-annealing processing as it is, and the case of once lowering the temperature and performing box annealing processing anew is sufficient as anneal after continuous annealing. Although what is necessary is just to be more than a recrystallizing temperature, since bi and rough-ization of crystal grain will break out if 750 degrees C is exceeded, the processing temperature of continu annealing of a preceding paragraph story is not desirable. In addition, the overaging processing said here means heat treatment in low temperature and a long time as compared with general annealing processing. Overaging processing performs soaking for 1 - 3 minutes at 400-550 degrees C, when carrying out after continuous annealing. At less than 400 degrees C, Dissolution C and N cannot be reduced, but if 550 degrees C is exceeded, crystal grain will make it b and rough. Moreover, in less than 1 minute, reduction of Dissolution C and N cannot be aimed at enough, but if 3 minutes is exceeded, in order that a length of chamber may make it huge, it considers as the range for 1 - 3 minutes. Moreover, box annealing is sufficient as overaging processing. When based on box annealing, the once lowered temperature is raised to 400-550 degrees C, and soaking is performed for 2 to 10 hours. The quality as overaging processing is not stabilized but a property differs in less than 400 degrees C. If 550 degrees C is exceeded, crystal gr will make it big and rough like continuous annealing. The quality as overaging processing is not stabilized but a property varies in less than 2 hours. On the other hand, the processing which passes 10 hours is not an economy top best policy.

[0010] Total elongation falls to the general effect of overaging processing by the increase in Dissolution C and N, an uniform elongation also deteriorates. This is considered because Dissolution C and N is acting on the vena contracta generated at the time of elongation, and the connection mechanism of a void. Overaging processing reduces the dissolution C and N in steel, and an effect is in elasticity-ization of steel. By performing overaging processing, the dissolution C and N among steel is reduced, generating of the vena contracta and connection of a void are suppressed and it is thought that fracture and body-breaking susceptibility are reduced as a result.

[0011] If a pace of expansion is the range which is 0.5 - 2.0%, since generating of a stretcher strain will be prevented this range is suitable for temper rolling temper rolling (the abbreviation for SR and Single Reduce Rolling).

[0012] Although DR rolling DR rolling is required in order to give the can intensity after fabrication, a rolling reduction may be 20 - 50%. At less than 20%, if sufficient can intensity is not obtained but 50% is exceeded, a steel plate will serve as high intensity and difficulty will be caused to a can fabricating operation. DR rolling is Double he Reduce Rolling It is abbreviation and is the rolling-out method to which decrease board thickness more positively an board intensity is made to increase from temper rolling. In this invention, it considers as secondary cold-rolling

including the above-mentioned temper rolling and DR rolling.
[0013] Next, as a steel plate used for this invention, what performed surface treatment is raised to the steel plate of th shape of the shape of a sheet, and a coil, steel foils, those steel plates, etc. That by which a chromium hydration oxid or the upper layer performed surface treatment with the two-layer structure where a chromium hydration oxide and a lower layer consist of a metal chromium layer to an electrolysis chromate-treatment steel plate [in which a lower lay has metal chromium and the upper layer has the two-layer structure of a chromium hydration oxide especially] or ultra-thin tin plated steel plate, and nickel-plating steel plate, galvanized steel sheets, and these plating steel plates is excellent in contact nature with polyester resin.
[0014] Specification of the diameter of the diameter crystal grain of average crystal grain is explained based on drawing 1 and drawing 2 . Drawing 1 shows the relation between the diameter of average crystal grain, and the surfa deterioration nature of the can side attachment wall after canning processing. Drawing 1 shows that the surface deterioration nature of the front face after canning processing deteriorates, when the diameter of average crystal grai becomes large. If the diameter of average crystal grain exceeds 6 micrometers, surface surface deterioration nature w deteriorate and the appearance and the property as a can will be spoiled. For this reason, the diameter of average crys grain decides not to exceed 6 micrometers. Moreover, drawing 2 shows the relation between the diameter of average crystal grain, and corrosion resistance. It turns out that corrosion resistance is good in the range in which the diamete of average crystal grain does not exceed 6 micrometers from drawing 2 , either. In addition, corrosion resistance evaluation was performed as follows. Heat treatment for 20 minutes was performed for the can after canning process at 130 degrees C, it was filled up with water, and viewing estimated the corrosion (melanism) grade of the can inside after 37 degrees C and the two-week passage of time.
[0015]
[Table 1]

鋼種記号	鋼の化学成分 (wt%)							
	C	Si	Mn	P	S	Sol.Al	N	Nb
A	0.06	0.03	0.35	0.011	0.011	0.044	0.0022	−
B	0.08	0.02	0.42	0.015	0.013	0.049	0.0033	−
C	0.11	0.01	0.56	0.018	0.010	0.035	0.0027	−
D	0.15	0.03	0.60	0.010	0.010	0.052	0.0063	−
E	0.01	0.01	0.15	0.016	0.016	0.047	0.0023	0.018
F	0.03	0.02	0.21	0.013	0.012	0.043	0.0031	0.002
G	0.002	0.01	0.18	0.009	0.013	0.052	0.0035	−

[0016]
[Table 2]

	No	鋼種記号	二次冷延	焼鈍条件	平均結晶粒径 (μm)	肌荒れ性	耐食性	加工性	総合評価
本発明	1	A	SR	有	5.5	○	○	○	○
	2	B	DR	有	5.3	◎	◎	○	◎
	3	C	DR	有	4.8	◎	◎	○	◎
	4	D	SR	有	4.3	◎	◎	○	◎
	5	E	DR	有	5.3	◎	◎	◎	◎
	6	F	DR	有	6.0	◎	◎	◎	◎
比較例	7	G	DR	有	8.3	×	×	△	×
	8	B	SR	無	5.2	◎	◎	△	△
	9	C	DR	無	4.8	◎	◎	△	△
	10	D	DR	無	4.2	◎	◎	△	△

焼鈍条件　過時効処理実施しているもの：有

〃　実施してないもの：無

[0017] Example No.1-6 of an evaluation this invention are carrying out overaging processing, and they are excellent processability with component within the limits of this invention. There are few amounts of C and example No.of comparison 7 are inferior in corrosion resistance. Example No.of comparison8-10 do not carry out overaging processing, but they are inferior in processability. In addition, the appraisal method was performed as follows here, respectively. Evaluation of surface deterioration nature measured the surface roughness of the can side attachment w of the can inside after thinning deep-drawing can fabrication, Ra made 1 micrometer or less O (best), and it made 1-1 micrometers O (good), made 1.5-2 micrometers ** (a little poor), and evaluated 2 micrometers or more as x (poor). Moreover, corrosion resistance evaluation performed heat treatment for 130 degree-Cx 20 minutes after thinning drawing can fabrication, it was filled up with water, and 37 degrees C estimated the corrosion (melanism) grade of th can inside after the two-week passage of time visually. That in which the front face has not carried out melanism at a was made into O (best), the grade of melanism made the minute thing O (good), the range of melanism made the thin (diameter of 5mm or less) of smallness ** (a little poor), and size (diameter of 5mm or more) was evaluated as x (poor). The size of ************ until it raises and carries out body breaking of the ************ and carries out i the time of thinning deep-drawing can fabrication estimated evaluation of processability. What made O (good) what ************ made what carried out body breaking by 5t or less ** (a little poor), and carried out body breaking by 7t, and carried out body breaking by 7t or more was made into O (best).

[0018]

[Effect of the Invention] By this invention, it can excel in surface deterioration nature and corrosion resistance, and body breaking cannot occur at the time of continuation high-speed canning processing, but the steel plate suitable fo the thinning deep-drawing can use which was moreover excellent in processability can be offered. In addition, as a c

use, as for the steel plate offered by this invention, a steel plate independent is usable, and it carries out surface treatment to this steel plate, and can use it also as a tin plate, TFS, a nickel-plating steel plate, etc. Furthermore, you may cover resin films, such as polyester, to the above-mentioned surface treated steel sheet. Moreover, what coated t steel plate with paints, such as epoxy, is applicable to a thinning deep-drawing can use.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] About container material, such as a food can and a drink can, especially this invention is excellent in deep-drawing processability, and its surface deterioration nature is good and it relates to the steel plate suitable for the corrosion resistance outstanding thinning deep-drawing can use, and its manufacturing method.

[Translation done.]

* NOTICES *

Japan Patent Office is not responsible for any
damages caused by the use of this translation.

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] conventionally, as a method of fabricating a side non-joint (side -- seamless) can, a res film is beforehand covered to the method of giving an organic paint within and without the can after fabricating a surface treated steel sheet, and the metal plate before fabrication, a resin film is used as a kind of forming lubricant, a there is the so-called thinning drawing can fabricating method which carries out the thinning of the metal plate of the portion used as a can side attachment wall As a latter example, this invention persons proposed the metal plate excellent in the surface deterioration-proof nature after canning, and corrosion resistance for thinning drawing cans previously by specifying the diameter of average crystal grain and average surface roughness of a metal plate (refer t JP,4-314535,A).

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] By this invention, it can excel in surface deterioration nature and corrosion resistance, and body breaking cannot occur at the time of continuation high-speed canning processing, but the steel plate suitable fo the thinning deep-drawing can use which was moreover excellent in processability can be offered. In addition, as a c use, as for the steel plate offered by this invention, a steel plate independent is usable, and it carries out surface treatment to this steel plate, and can use it also as a tin plate, TFS, a nickel-plating steel plate, etc. Furthermore, you may cover resin films, such as polyester, to the above-mentioned surface treated steel sheet. Moreover, what coated t steel plate with paints, such as epoxy, is applicable to a thinning deep-drawing can use.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, when a thinning drawing can is fabricated using the convention metal plate which covered the resin film beforehand, there is a problem of a surface deterioration plain-gauze cone in the can side attachment wall after completion extremely. That is, the path clearance of a dice and punch is larger than the thickness of a can side attachment wall, and since a can side attachment wall is not restrained by punch and the d but serves as the so-called free surface at the time of processing, compared with the DI (Draw and Ironing) fabricatin method, there is a problem of a surface deterioration plain-gauze cone in a can side attachment wall. If this surface deterioration state arises, the adhesion force of a negative and a film will decrease and it will also become the cause o film ablation. Moreover, the shock from the outside, such as contact of the cans under transportation, becomes a trigger, and surface deterioration makes a film plane produce a detailed crack, as a result also has the problem of causing corrosion resistance degradation. Usually, a thinning deep-drawing can pierces cladding to disc-like, and two steps of spinning fabricates this. The thickness of a can side attachment wall is decreased by applying the high blank holder force to a flange at the time of the second step of this spinning (redrawing processing), and performing drawin buckling-of-track processing of a can side attachment wall. In the above-mentioned processing method, since redrawing processing was the very severe fabricating method, there was a problem that body breaking tends to happe at the time of continuous molding. If such body breaking happens, in order to spoil the productivity of high-speed canning processing, it was pressing need to develop the steel plate suitable for the thinning deep-drawing can use wh body breaking could not happen easily and was moreover excellent in processability. Surface deterioration nature an corrosion resistance are excellent for the purpose of solving the above-mentioned trouble, and body breaking does no occur at the time of continuation high-speed canning processing, but this invention aims at offering the steel plate suitable for the thinning deep-drawing can use which was moreover excellent in processability, and its manufacturin method.

[Translation done.]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] The steel plate suitable for the thinning deep-drawing can use of this invention is C:0.01 - 0.15%. Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%, annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel wh consists of the remainder Fe and an unescapable impurity, and temper rolling with a pace of expansion of 0.5 - 2.0% are performed one by one, and it is desirable for the diameter of average crystal grain of the steel plate after temper rolling to be 6.0 micrometers or less. Moreover, C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%, annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, a DR rolling at 20 - 50% of rolling reductions are performed one by one, and that whose diameter of average crystal grain of the steel plate after DR rolling is 6.0 micrometers or less is Furthermore, C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, Nb:0.001-0.020%, Even if it performs annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled shee steel which consists of the remainder Fe and an unescapable impurity, and temper rolling with a pace of expansion o 0.5 - 2.0% one by one and the diameter of average crystal grain of the steel plate after temper rolling is 6.0 micromet or less. It is good. Moreover, C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10 N:0.0020 - 0.015%, and Nb:0.001-0.020%, annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and DR rolling at 20 - 50% of rolling reductions are performed one by one, and it is desirable for the diameter of average crystal grain of the steel plate after DR rolling to be also 6.0 micrometers or less. The manufacturing method of the steel plate which next fitted the thinning deep-drawing can use of this invention, It is desirable to perform annealing the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists o the remainder Fe and an unescapable impurity, and temper rolling with a pace of expansion of 0.5 - 2.0% one by one C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%. Moreover, it is also desirable to perform annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and DR rolling at 20 - 50% of rolling reductions one by one C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04% aluminum:0.015-0.10%, and N:0.0020 to 0.015%. Furthermore, you may perform annealing by the thermo cycle wh includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and a unescapable impurity, and temper rolling with a pace of expansion of 0.5 - 2.0% one by one C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04%, aluminum:0.015-0.10%, N:0.0020 - 0.015%, and Nb:0.001-0.020% Moreover, it is also desirable to perform annealing by the thermo cycle which includes cold rolling and overaging processing for the hot rolled sheet steel which consists of the remainder Fe and an unescapable impurity, and DR rolling of 20 - 50% of rolling reductions one by one C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S<=0.04% aluminum:0.015-0.10%, N:0.0020 - 0.015%, and Nb:0.001-0.020%.

[Translation done.]

OPERATION

[Function] Resin films, such as polyester, are covered to the steel plate of this invention, it pierces to disc-like, and th thinning deep-drawing can which body breaking did not occur but was moreover excellent in processability in this ev if it performed continuation high-speed canning processing of 2 stage drawing can be fabricated.

[Translation done.]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EXAMPLE

[Example]
The component steel component of a hot rolled sheet steel consists of Remainder Fe and an unescapable impurity C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S= 0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%. Moreover, what added Nb to the above-mentioned component 0.001 to 0.02% is used suitably. The reason for regulation of a steel component is explained below. When C became less than 0.01%, it caused big and rough-ization crystal grain, and it made the minimum 0.01%. On the other hand, since spinning nature deteriorated exceeding 0.15 the range was made into 0.08 - 0.15%. Although Si was an element detrimental to corrosion resistance as a charge of can material, it is an element contained unescapable as aluminum killed steel, and made the upper limit 0.05%. Although Mn was a component required in order to prevent the red shortness under hot-rolling by S which is an impurity, since it deteriorated spinning nature as on the other hand exceeding 0.9%, it made the upper limit 0.9%. Although P is a component effective in grain refining and it is added at a fixed rate from raising the intensity of a negative, corrosion resistance is ****(ed) by one side. When P exceeded 0.04% as a steel-for-can board of this invention use, corrosion resistance and since especially ******-proof fell remarkably, the upper limit was made into 0.04%. S was an impurity component which produces the red shortness under hot-rolling, as much as possible, although the few thing was desirable, is an element contained unescapable and made the upper limit 0.04%. Althoug is added in a steel bath as a deoxidizer and aluminum is removed as a slag on the occasion of steel manufacture, sinc the deoxidation effect stabilized when there were few additions is not acquired, it needs 0.015% or more. Moreover, aluminum reacts with **** N, deposits as AlN, and contributes to grain refining of crystal grain. On the other hand, since there were few technical effects and they were not desirable on economy, the addition exceeding 0.10% made t upper limit 0.10%. since it will be easy to produce a crack on a slab front face and will become a structure defect, if there are few deposits with a nitride when fewer than 0.002%, the effect of grain refining is lost and 0.015% is exceeded on the other hand, although N forms aluminum and Nb, and a nitride and it is a component effective in gra refining of a fine-grain grain -- the range -- 0.002 - 0.015% -- the bottom Nb has an effect in grain refining of crystal grain, and contributes to reduction of Dissolution C and N. when fewer than 0.001%, there was no effect of grain refining, and the upper limit was made into 0.020%, in order for the amount of dissolution Nb(s) to increase and to cause degradation of spinning nature conversely on the other hand, if 0.020% is exceeded
[0007] Although slab heating temperature and hot rolling conditions are not specified by this invention, as for slab heating temperature, it is desirable to consider as 1100 degrees C or more from the standpoint of positive decomposition dissolution of N and stable reservation of hot rolling temperature. It is hot rolling finishing temperatu Ar3 Since it will be made big and rough while the crystalline structure of a hot-rolling board mixed-grain-size-izes if carries out to below a point, hot rolling finishing temperature is Ar3. It carried out to beyond the point. Moreover, sin crystal grain will turn big and rough and surface deterioration will produce winding temperature if it makes a minimu 450 degrees C in consideration of the quality stability of the coil cross direction at the time of hot-rolling, and a longitudinal direction and 650 degrees C is exceeded, winding temperature has the desirable range of 450-650 degre C.
[0008] Since a cold rolling process rolling reduction cannot bring about coarsening of a steel plate, or mixed-grain-si ization at an annealing process and cannot carry out grain refining of the crystal grain enough at less than 75%, as fo the rolling reduction of cold rolling, it is desirable to make 75% into a minimum.
[0009] In the annealing process this invention, it became clear by adopting annealing by the thermo cycle including overaging processing that an effect is in body breaking. This is considered to be based on what Dissolution C and N reduced. Which art in the case where overaging processing is performed by continuous-annealing processing as it is,

and the case of once lowering the temperature and performing box annealing processing anew is sufficient as anneal after continuous annealing. Although what is necessary is just to be more than a recrystallizing temperature, since bi and rough-ization of crystal grain will break out if 750 degrees C is exceeded, the processing temperature of continu annealing of a preceding paragraph story is not desirable. In addition, the overaging processing said here means heat treatment in low temperature and a long time as compared with general annealing processing. Overaging processing performs soaking for 1 - 3 minutes at 400-550 degrees C, when carrying out after continuous annealing. At less than 400 degrees C, Dissolution C and N cannot be reduced, but if 550 degrees C is exceeded, crystal grain will make it b and rough. Moreover, in less than 1 minute, reduction of Dissolution C and N cannot be aimed at enough, but if 3 minutes is exceeded, in order that a length of chamber may make it huge, it considers as the range for 1 - 3 minutes. Moreover, box annealing is sufficient as overaging processing. When based on box annealing, the once lowered temperature is raised to 400-550 degrees C, and soaking is performed for 2 to 10 hours. The quality as overaging processing is not stabilized but a property differs in less than 400 degrees C. If 550 degrees C is exceeded, crystal gr will make it big and rough like continuous annealing. The quality as overaging processing is not stabilized but a property varies in less than 2 hours. On the other hand, the processing which passes 10 hours is not an economy top best policy.

[0010] Total elongation falls to the general effect of overaging processing by the increase in Dissolution C and N, an uniform elongation also deteriorates. This is considered because Dissolution C and N is acting on the vena contracta generated at the time of elongation, and the connection mechanism of a void. Overaging processing reduces the dissolution C and N in steel, and an effect is in elasticity-ization of steel. By performing overaging processing, the dissolution C and N among steel is reduced, generating of the vena contracta and connection of a void are suppressed and it is thought that fracture and body-breaking susceptibility are reduced as a result.

[0011] If a pace of expansion is the range which is 0.5 - 2.0%, since generating of a stretcher strain will be prevented this range is suitable for temper rolling temper rolling (the abbreviation for SR and Single Reduce Rolling).

[0012] Although DR rolling DR rolling is required in order to give the can intensity after fabrication, a rolling reduction may be 20 - 50%. At less than 20%, if sufficient can intensity is not obtained but 50% is exceeded, a steel plate will serve as high intensity and difficulty will be caused to a can fabricating operation. DR rolling is Double he Reduce Rolling It is abbreviation and is the rolling-out method to which decrease board thickness more positively an board intensity is made to increase from temper rolling. In this invention, it considers as secondary cold-rolling including the above-mentioned temper rolling and DR rolling.

[0013] Next, as a steel plate used for this invention, what performed surface treatment is raised to the steel plate of th shape of the shape of a sheet, and a coil, steel foils, those steel plates, etc. That by which a chromium hydration oxid or the upper layer performed surface treatment with the two-layer structure where a chromium hydration oxide and a lower layer consist of a metal chromium layer to an electrolysis chromate-treatment steel plate [in which a lower lay has metal chromium and the upper layer has the two-layer structure of a chromium hydration oxide especially] or ultra-thin tin plated steel plate, and nickel-plating steel plate, galvanized steel sheets, and these plating steel plates is excellent in contact nature with polyester resin.

[0014] Specification of the diameter of the diameter crystal grain of average crystal grain is explained based on drawing 1 and drawing 2 . Drawing 1 shows the relation between the diameter of average crystal grain, and the surfa deterioration nature of the can side attachment wall after canning processing. Drawing 1 shows that the surface deterioration nature of the front face after canning processing deteriorates, when the diameter of average crystal grai becomes large. If the diameter of average crystal grain exceeds 6 micrometers, surface surface deterioration nature w deteriorate and the appearance and the property as a can will be spoiled. For this reason, the diameter of average crys grain decides not to exceed 6 micrometers. Moreover, drawing 2 shows the relation between the diameter of average crystal grain, and corrosion resistance. It turns out that corrosion resistance is good in the range in which the diamete of average crystal grain does not exceed 6 micrometers from drawing 2 , either. In addition, corrosion resistance evaluation was performed as follows. Heat treatment for 20 minutes was performed for the can after canning process at 130 degrees C, it was filled up with water, and viewing estimated the corrosion (melanism) grade of the can inside after 37 degrees C and the two-week passage of time.

[0015]

[Table 1]

鋼種記号	鋼の化学成分 (wt%)							
	C	Si	Mn	P	S	Sol.Al	N	Nb
A	0.06	0.03	0.35	0.011	0.011	0.044	0.0022	–
B	0.08	0.02	0.42	0.015	0.013	0.049	0.0033	–
C	0.11	0.01	0.56	0.018	0.010	0.035	0.0027	–
D	0.15	0.03	0.60	0.010	0.010	0.052	0.0063	–
E	0.01	0.01	0.15	0.016	0.016	0.047	0.0023	0.018
F	0.03	0.02	0.21	0.013	0.012	0.043	0.0031	0.002
G	0.002	0.01	0.18	0.009	0.013	0.052	0.0035	–

[0016]
[Table 2]

	No	鋼種記号	二次冷延	焼鈍条件	平均結晶粒径 (μm)	肌荒れ性	耐食性	加工性	総合評価
本発明	1	A	SR	有	5.5	○	○	○	○
	2	B	DR	有	5.3	◎	◎	○	◎
	3	C	DR	有	4.8	◎	◎	○	◎
	4	D	SR	有	4.3	◎	◎	○	◎
	5	E	DR	有	5.3	◎	◎	◎	◎
	6	F	DR	有	6.0	◎	◎	◎	◎
比較例	7	G	DR	有	8.3	×	×	△	×
	8	B	SR	無	5.2	◎	◎	△	△
	9	C	DR	無	4.8	◎	◎	△	△
	10	D	DR	無	4.2	◎	◎	△	△

焼鈍条件　過時効処理実施しているもの：有

〃　実施してないもの：無

[0017] Example No.1-6 of an evaluation this invention are carrying out overaging processing, and they are excellent processability with component within the limits of this invention. There are few amounts of C and example No.of comparison 7 are inferior in corrosion resistance. Example No.of comparison8-10 do not carry out overaging processing, but they are inferior in processability. In addition, the appraisal method was performed as follows here, respectively. Evaluation of surface deterioration nature measured the surface roughness of the can side attachment w of the can inside after thinning deep-drawing can fabrication, Ra made 1 micrometer or less O (best), and it made 1-1 micrometers O (good), made 1.5-2 micrometers ** (a little poor), and evaluated 2 micrometers or more as x (poor). Moreover, corrosion resistance evaluation performed heat treatment for 130 degree-Cx 20 minutes after thinning drawing can fabrication, it was filled up with water, and 37 degrees C estimated the corrosion (melanism) grade of th can inside after the two-week passage of time visually. That in which the front face has not carried out melanism at a was made into O (best), the grade of melanism made the minute thing O (good), the range of melanism made the thin (diameter of 5mm or less) of smallness ** (a little poor), and size (diameter of 5mm or more) was evaluated as x (poor). The size of ************ until it raises and carries out body breaking of the ************ and carries out i the time of thinning deep-drawing can fabrication estimated evaluation of processability. What made O (good) what ************ made what carried out body breaking by 5t or less ** (a little poor), and carried out body breaking by 7t, and carried out body breaking by 7t or more was made into O (best).

[Translation done.]

* NOTICES *

EXAMPLE

[Example]
The component steel component of a hot rolled sheet steel consists of Remainder Fe and an unescapable impurity C:0.01 - 0.15%, Si<=0.05%, Mn<=0.9%, P<=0.04%, S= 0.04%, aluminum:0.015-0.10%, and N:0.0020 to 0.015%. Moreover, what added Nb to the above-mentioned component 0.001 to 0.02% is used suitably. The reason for regulation of a steel component is explained below. When C became less than 0.01%, it caused big and rough-ization crystal grain, and it made the minimum 0.01%. On the other hand, since spinning nature deteriorated exceeding 0.15 the range was made into 0.08 - 0.15%. Although Si was an element detrimental to corrosion resistance as a charge of can material, it is an element contained unescapable as aluminum killed steel, and made the upper limit 0.05%. Although Mn was a component required in order to prevent the red shortness under hot-rolling by S which is an impurity, since it deteriorated spinning nature as on the other hand exceeding 0.9%, it made the upper limit 0.9%. Although P is a component effective in grain refining and it is added at a fixed rate from raising the intensity of a negative, corrosion resistance is ****(ed) by one side. When P exceeded 0.04% as a steel-for-can board of this invention use, corrosion resistance and since especially ******-proof fell remarkably, the upper limit was made into 0.04%. S was an impurity component which produces the red shortness under hot-rolling, as much as possible, although the few thing was desirable, is an element contained unescapable and made the upper limit 0.04%. Althoug is added in a steel bath as a deoxidizer and aluminum is removed as a slag on the occasion of steel manufacture, sinc the deoxidation effect stabilized when there were few additions is not acquired, it needs 0.015% or more. Moreover, aluminum reacts with **** N, deposits as AlN, and contributes to grain refining of crystal grain. On the other hand, since there were few technical effects and they were not desirable on economy, the addition exceeding 0.10% made t upper limit 0.10%. since it will be easy to produce a crack on a slab front face and will become a structure defect, if there are few deposits with a nitride when fewer than 0.002%, the effect of grain refining is lost and 0.015% is exceeded on the other hand, although N forms aluminum and Nb, and a nitride and it is a component effective in gra refining of a fine-grain grain -- the range -- 0.002 - 0.015% -- the bottom Nb has an effect in grain refining of crystal grain, and contributes to reduction of Dissolution C and N. when fewer than 0.001%, there was no effect of grain refining, and the upper limit was made into 0.020%, in order for the amount of dissolution Nb(s) to increase and to cause degradation of spinning nature conversely on the other hand, if 0.020% is exceeded
[0007] Although slab heating temperature and hot rolling conditions are not specified by this invention, as for slab heating temperature, it is desirable to consider as 1100 degrees C or more from the standpoint of positive decomposition dissolution of N and stable reservation of hot rolling temperature. It is hot rolling finishing temperatu Ar3 Since it will be made big and rough while the crystalline structure of a hot-rolling board mixed-grain-size-izes if carries out to below a point, hot rolling finishing temperature is Ar3. It carried out to beyond the point. Moreover, sin crystal grain will turn big and rough and surface deterioration will produce winding temperature if it makes a minimu 450 degrees C in consideration of the quality stability of the coil cross direction at the time of hot-rolling, and a longitudinal direction and 650 degrees C is exceeded, winding temperature has the desirable range of 450-650 degre C.
[0008] Since a cold rolling process rolling reduction cannot bring about coarsening of a steel plate, or mixed-grain-si ization at an annealing process and cannot carry out grain refining of the crystal grain enough at less than 75%, as fo the rolling reduction of cold rolling, it is desirable to make 75% into a minimum.
[0009] In the annealing process this invention, it became clear by adopting annealing by the thermo cycle including overaging processing that an effect is in body breaking. This is considered to be based on what Dissolution C and N reduced. Which art in the case where overaging processing is performed by continuous-annealing processing as it is,

and the case of once lowering the temperature and performing box annealing processing anew is sufficient as anneal after continuous annealing. Although what is necessary is just to be more than a recrystallizing temperature, since bi and rough-ization of crystal grain will break out if 750 degrees C is exceeded, the processing temperature of continu annealing of a preceding paragraph story is not desirable. In addition, the overaging processing said here means heat treatment in low temperature and a long time as compared with general annealing processing. Overaging processing performs soaking for 1 - 3 minutes at 400-550 degrees C, when carrying out after continuous annealing. At less than 400 degrees C, Dissolution C and N cannot be reduced, but if 550 degrees C is exceeded, crystal grain will make it b and rough. Moreover, in less than 1 minute, reduction of Dissolution C and N cannot be aimed at enough, but if 3 minutes is exceeded, in order that a length of chamber may make it huge, it considers as the range for 1 - 3 minutes. Moreover, box annealing is sufficient as overaging processing. When based on box annealing, the once lowered temperature is raised to 400-550 degrees C, and soaking is performed for 2 to 10 hours. The quality as overaging processing is not stabilized but a property differs in less than 400 degrees C. If 550 degrees C is exceeded, crystal gr will make it big and rough like continuous annealing. The quality as overaging processing is not stabilized but a property varies in less than 2 hours. On the other hand, the processing which passes 10 hours is not an economy top best policy.

[0010] Total elongation falls to the general effect of overaging processing by the increase in Dissolution C and N, an uniform elongation also deteriorates. This is considered because Dissolution C and N is acting on the vena contracta generated at the time of elongation, and the connection mechanism of a void. Overaging processing reduces the dissolution C and N in steel, and an effect is in elasticity-ization of steel. By performing overaging processing, the dissolution C and N among steel is reduced, generating of the vena contracta and connection of a void are suppressed and it is thought that fracture and body-breaking susceptibility are reduced as a result.

[0011] If a pace of expansion is the range which is 0.5 - 2.0%, since generating of a stretcher strain will be prevented this range is suitable for temper rolling temper rolling (the abbreviation for SR and Single Reduce Rolling).

[0012] Although DR rolling DR rolling is required in order to give the can intensity after fabrication, a rolling reduction may be 20 - 50%. At less than 20%, if sufficient can intensity is not obtained but 50% is exceeded, a steel plate will serve as high intensity and difficulty will be caused to a can fabricating operation. DR rolling is Double he Reduce Rolling It is abbreviation and is the rolling-out method to which decrease board thickness more positively an board intensity is made to increase from temper rolling. In this invention, it considers as secondary cold-rolling including the above-mentioned temper rolling and DR rolling.

[0013] Next, as a steel plate used for this invention, what performed surface treatment is raised to the steel plate of th shape of the shape of a sheet, and a coil, steel foils, those steel plates, etc. That by which a chromium hydration oxid or the upper layer performed surface treatment with the two-layer structure where a chromium hydration oxide and a lower layer consist of a metal chromium layer to an electrolysis chromate-treatment steel plate [in which a lower lay has metal chromium and the upper layer has the two-layer structure of a chromium hydration oxide especially] or ultra-thin tin plated steel plate, and nickel-plating steel plate, galvanized steel sheets, and these plating steel plates is excellent in contact nature with polyester resin.

[0014] Specification of the diameter of the diameter crystal grain of average crystal grain is explained based on drawing 1 and drawing 2 . Drawing 1 shows the relation between the diameter of average crystal grain, and the surfa deterioration nature of the can side attachment wall after canning processing. Drawing 1 shows that the surface deterioration nature of the front face after canning processing deteriorates, when the diameter of average crystal grai becomes large. If the diameter of average crystal grain exceeds 6 micrometers, surface surface deterioration nature w deteriorate and the appearance and the property as a can will be spoiled. For this reason, the diameter of average crys grain decides not to exceed 6 micrometers. Moreover, drawing 2 shows the relation between the diameter of average crystal grain, and corrosion resistance. It turns out that corrosion resistance is good in the range in which the diamete of average crystal grain does not exceed 6 micrometers from drawing 2 , either. In addition, corrosion resistance evaluation was performed as follows. Heat treatment for 20 minutes was performed for the can after canning process at 130 degrees C, it was filled up with water, and viewing estimated the corrosion (melanism) grade of the can inside after 37 degrees C and the two-week passage of time.

[0015]

[Table 1]

鋼種記号	鋼の化学成分 (wt%)							
	C	Si	Mn	P	S	Sol.Al	N	Nb
A	0.06	0.03	0.35	0.011	0.011	0.044	0.0022	—
B	0.08	0.02	0.42	0.015	0.013	0.049	0.0033	—
C	0.11	0.01	0.56	0.018	0.010	0.035	0.0027	—
D	0.15	0.03	0.60	0.010	0.010	0.052	0.0063	—
E	0.01	0.01	0.15	0.016	0.016	0.047	0.0023	0.018
F	0.03	0.02	0.21	0.013	0.012	0.043	0.0031	0.002
G	0.002	0.01	0.18	0.009	0.013	0.052	0.0035	—

[0016]
[Table 2]

	No	鋼種記号	二次冷延	焼鈍条件	平均結晶粒径 (μm)	肌荒れ性	耐食性	加工性	総合評価
本発明	1	A	SR	有	5.5	○	○	○	○
	2	B	DR	有	5.3	◎	◎	○	◎
	3	C	DR	有	4.8	◎	◎	○	◎
	4	D	SR	有	4.3	◎	◎	○	◎
	5	E	DR	有	5.3	◎	◎	◎	◎
	6	F	DR	有	6.0	◎	◎	◎	◎
比較例	7	G	DR	有	8.3	×	×	△	×
	8	B	SR	無	5.2	◎	◎	△	△
	9	C	DR	無	4.8	◎	◎	△	△
	10	D	DR	無	4.2	◎	◎	△	△

焼鈍条件　過時効処理実施しているもの：有

〃　実施してないもの：無

[0017] Example No.1-6 of an evaluation this invention are carrying out overaging processing, and they are excellent processability with component within the limits of this invention. There are few amounts of C and example No.of comparison 7 are inferior in corrosion resistance. Example No.of comparison8-10 do not carry out overaging processing, but they are inferior in processability. In addition, the appraisal method was performed as follows here, respectively. Evaluation of surface deterioration nature measured the surface roughness of the can side attachment w of the can inside after thinning deep-drawing can fabrication, Ra made 1 micrometer or less O (best), and it made 1-1 micrometers O (good), made 1.5-2 micrometers ** (a little poor), and evaluated 2 micrometers or more as x (poor). Moreover, corrosion resistance evaluation performed heat treatment for 130 degree-Cx 20 minutes after thinning drawing can fabrication, it was filled up with water, and 37 degrees C estimated the corrosion (melanism) grade of th can inside after the two-week passage of time visually. That in which the front face has not carried out melanism at a was made into O (best), the grade of melanism made the minute thing O (good), the range of melanism made the thin (diameter of 5mm or less) of smallness ** (a little poor), and size (diameter of 5mm or more) was evaluated as x (poor). The size of ************ until it raises and carries out body breaking of the ************ and carries out i the time of thinning deep-drawing can fabrication estimated evaluation of processability. What made O (good) what ************ made what carried out body breaking by 5t or less ** (a little poor), and carried out body breaking by 7t, and carried out body breaking by 7t or more was made into O (best).

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the graph which shows the influence of the diameter of average crystal grain exerted on surface deterioration nature.
[Drawing 2] It is the graph which shows the influence of the diameter of average crystal grain exerted on corrosion resistance.

[Translation done.]

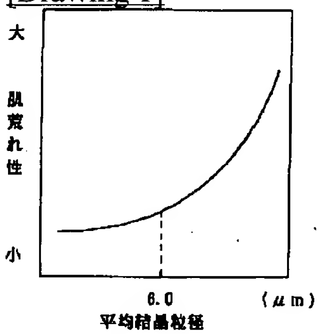
* NOTICES *

Japan Patent Office is not responsible for any
damages caused by the use of this translation.

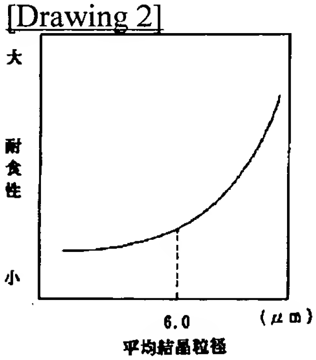
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]